63-4-2

LABORATORIES DIVISION

INFORMAL REPORT

INSTRUMENT-ELECTRICAL LABORATORY

Project Title: Type 2HN Storage Battery - Qualification Test

Report No. 3452 (Final) Date: 13 February 1956

Laboratory Work Order No. 2430

Ord. Project No. TT1-720B

DETROIT ARSENAL

CENTER LINE, MICHIGAN

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Center Line, Michigan

LABORATORIES DIVISION
Instrument-Electrical Laboratory

PROJECT TITLE: Type 2HN Storage Battery - Qualification Test

Report No. 3452 (Final) Date: 13 February 1956

Prepared By: Joseph H. Reinman

Initiation Date of Project: 13 January 1955

Laboratory Work Order No. 2430

Ord. Project No. TT1-720B

DETROIT ARSENAL
Laboratories Division

Report No. 3452 (Final)
13 February 1956

PROJECT TITLE: TYPE 2HN STORAGE BATTERY - QUALIFICATION TEST

OBJECT:

Determine compliance of Code "A" storage batteries with Specification MIL-B-11188A, dated 22 March 1954, and ECO No.44185, dated 27 July 1954.

SUMMARY:

1. Code "A" batteries 1, 2 and 3 failed to meet the requirements of the Overcharge test.
2. Batteries 4, 5 and 6 failed to meet the requirements of the Life Cycle test.
3. The results of the tests on batteries 1 through 6 are tabulated in Inclosures 1 through 8.
4. Tests on the remaining batteries were discontinued at the request of the project engineer.

CONCLUSIONS:

Code "A" Type 2HN storage batteries did not meet the requirements of Specification MIL-B-11188A, dated 22 March 1954, and ECO No. 44185, dated 27 July 1954.

Written By:

JOSEPH H. REINMAN

Approved By:

GEORGE A. TUTTLE
Major, Ordnance Corps
OIC, Laboratories Division

Reviewed By:

RALPH MARINELLI, Acting Chief
Instrument-Electrical Laboratory

DETROIT ARSENAL
Laboratories Division

TECHNICAL REPORT DISTRIBUTION

Report No. 3452 (Final)

PROJECT TITLE: TYPE 2HN STORAGE BATTERY - QUALIFICATION TEST

OIC, Research & Development Division	(1)
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INCLOSURE SHEET

Inclosure 1 - Table I - Filled Discharge Test

Inclosure 2 - Table II - Capacity Test

Inclosure 3 - Table III - Low Temperature Cranking Test

Inclosure 4 - Table IV - Retention of Charge Test

Inclosure 5 - Table V - Type 2HN Overcharge Cycle Test

Inclosure 6 - Table VI - Type 2HN Life Cycle Test

Inclosure 7 - Table VII - Disassembly Report

Inclosure 8 - Table VIII - Disassembly Report

Inclosure 9 - Laboratory Work Order 2430

Control Number	Battery Type	Electrolyte Temp. °F	Cell 1	Cell 2	Cell 3	Cell 4	Cell 5	Cell 6
A-1	2HN	84	1.260	1.252	1.252	1.258	1.242	1.259
A-2	2HN	84	1.257	1.273	1.262	1.259	1.257	1.259
A-3	2HN	84	1.264	1.252	1.258	1.267	1.262	1.269

Specific Gravities 4 Hours After Filling

Battery Number	Rate In Amperes	Open Circuit Voltage	5 Second Voltage	Time In Minutes	End Voltage
A-1	150	12.60	9.30	4.28	6.00
A-2	150	12.60	10.10	4.84	6.00
A-3	150	12.61	9.80	4.72	6.00

80° F Discharge

FILLED DISCHARGE TEST

Inclosure 1

TABLE I

Battery Numbers	Battery Type	Cell 1	Cell 2	Cell 3	Cell 4	Cell 5	Cell 6
A-1	2HN	1.297	1.297	1.296	1.296	1.292	1.294
A-2	2HN	1.302	1.301	1.301	1.296	1.297	1.297
A-3	2HN	1.302	1.297	1.301	1.298	1.299	1.301

Specific Gravities Prior to Test

Battery Number	Test Temp.° F	Rate In Amperes	End Voltage	Time In Hours	Capacity In A. H.
A-1	80	2.25	10.50	21.40	48.15
A-2	80	2.25	10.50	21.34	48.01
A-3	80	2.25	10.50	21.23	47.77

20 Hour Rate Discharge

CAPACITY TEST

Inclosure 2

TABLE II

Battery Number	Battery Type	Cell 1	Cell 2	Cell 3	Cell 4	Cell 5	Cell 6
A-1	2HN	1.295	1.299	1.290	1.287	1.290	1.295
A-2	2HN	1.300	1.299	1.299	1.300	1.292	1.295
A-3	2HN	1.295	1.298	1.295	1.298	1.290	1.298

Specific Gravities Prior to Test

Battery Number	Rate In Amperes	Open Circuit Voltage	5 Second Voltage	Time In Minutes	End Voltage	Test Temp.° F
A-1	150	13.20	7.50	1.35	6.00	-41
A-2	150	13.20	7.50	1.24	6.00	-41
A-3	150	13.20	7.55	1.34	6.00	-41

Note: 5 Second requirement, 7.0 Volts. Time requirement 1.25 minutes average.

-40° F Discharge

LOW TEMPERATURE CRANKING TEST

Inclosure 3

TABLE III

Battery Number	Battery Type	Date Recorded	Cell 1	Cell 2	Cell 3	Cell 4	Cell 5	Cell 6
A-1	2HN	2/10/55	1.301	1.302	1.292	1.292	1.292	1.288
A-2	2HN	2/10/55	1.305	1.302	1.302	1.307	1.297	1.302
A-3	2HN	2/10/55	1.302	1.303	1.300	1.302	1.297	1.302

Specific Gravities Before Retention Test

A-1	2HN	3/10/55	1.263	1.264	1.258	1.265	1.257	1.263
A-2	2HN	3/10/55	1.258	1.268	1.263	1.275	1.268	1.260
A-3	2HN	3/10/55	1.273	1.260	1.268	1.268	1.268	1.271

Specific Gravities After Retention Test

Battery Number	Rate In Amperes	Time In Hours	End Voltage	Capacity In A. H.
A-1	2.25	19.86	10.5	44.68
A-2	2.25	19.62	10.5	44.14
A-3	2.25	19.84	10.5	44.64

Capacity Results

RETENTION OF CHARGE TEST

Inclosure 4

TABLE IV

Battery Code	Discharge Rate In Amps	Open Circuit Voltage	End Voltage	Time In Minutes	Total Cycles	Date Conducted
A-1	150	12.80	6.00	8.12	1	4/12/55
A-2	150	12.82	6.00	8.28	1	4/12/55
A-3	150	12.82	6.00	8.92	1	4/12/55
A-1	150	12.61	6.00	6.35	2	4/21/55
A-2	150	12.75	6.00	6.95	2	4/21/55
A-3	150	10.60	6.00	*	1	4/21/55
A-1	150	10.60	6.00	*	2	4/28/55
A-2	150	12.89	6.00	6.75	3	4/28/55
A-3	150	10.60	6.00	*	1	4/28/55
A-1	150	10.40	6.00	*	2	5/5/55
A-2	150	12.82	6.00	5.92	4	5/5/55
A-2	150	12.79	6.00	9.80	5	5/13/55
A-2	150	12.70	6.00	4.38	6	5/20/55
A-2	150	12.71	6.00	2.78	7	5/27/55
A-2	150	12.81	6.00	1.97	8	6/3/55
A-2	150	8.85	6.00	*	8	6/13/55

* Fell below end voltage when load was applied

TYPE 2HN OVERCHARGE CYCLE TEST

Inclosure 5

TABLE V

Battery Number	Discharge Rate In Amps	Open Circuit Voltage	End Voltage	Time In Hours	Capacity In A. H.	Total Passing Cycles	Date Conducted
A-4	20.0	13.00	10.20	2.04	40.80	23	2/14/55
A-5	20.0	13.01	10.20	2.03	40.60	23	2/14/55
A-6	20.0	12.99	10.20	1.98	39.60	23	2/14/55
A-4	20.0	12.99	10.20	1.84	36.80	51	2/21/55
A-5	20.0	13.00	10.20	1.79	35.80	51	2/21/55
A-6	20.0	13.00	10.20	1.71	34.20	51	2/21/55
A-4	20.0	13.20	10.20	1.58	31.60	76	3/1/55
A-5	20.0	13.29	10.20	1.46	29.20	76	3/1/55
A-6	20.0	13.25	10.20	1.40	28.00	76	3/1/55
A-4	20.0	12.80	10.20	1.48	29.60	100	3/9/55
A-5	20.0	12.75	10.20	1.11	22.20	100	3/9/55
A-6	20.0	12.75	10.20	0.98	19.60	100	3/9/55
A-4	20.0	12.70	10.20	0.79	15.80	125	3/16/55
A-5	20.0	12.70	10.20	0.79	14.00	100	3/16/55
A-6	20.0	12.70	10.20	0.74	14.80	100	3/16/55
A-4	20.0	12.90	10.20	0.94	18.80	149	3/23/55
A-5	20.0	12.80	10.20	0.72	14.40	100	3/23/55
A-6	20.0	12.79	10.20	0.71	14.20	100	3/23/55
A-4	20.0	12.80	6.20	0.74	14.80	149	3/30/55
A-5	20.0	12.60	10.20	0.36	7.20	100	3/30/55
A-6	20.0	12.60	10.20	0.30	6.00	100	3/30/55

TYPE 2HN LIFE CYCLE TEST

Inclosure 6

TABLE VI

Manufacturer	Code "A"	Date	6 April 1955
Type	2HN	Test	Life
Battery Code	A-5	Cycles	105
General Appearance Before Disassembly			Good

POSITIVE PLATES

Upper quarter bare	Yes
Lower quarter bare	No
Bare in spots	Yes
Shedding uniform	No
Shedding normal	No
Remainder surf.smooth	No
Remainder surf.pitted	Yes
Remainder appeared lumpy	No
Remainder soft & loose	Yes
Surface scaly	No
Loose matl.stuck to sep	Yes
Oxidation of grids	Yes
Buckling	No
Distortion of grid frames	No
Grid frames broken	No

SEDIMENT SPACES

Level full	Yes
Overflowing-elements bridged	Yes
Color	Brownish

NEGATIVE PLATES

Color	Gray
Expanded	Yes
Uniformity of expansion	EntirePlate
Surface blistered	No
Surface firm Yes Sandy	Yes
Density of interior-upper half	Good
Density of interior-lower half	Good
Material contracted	Yes

SEPARATORS

Type	Rubber (Microporous)
Flexibility	Good
Degree of oxidation	Very Slight
Any holes	No
Fringed at bottom	No
Exceptionally thin	No
Capable of being handled intact	Yes
Badly disintegrated parts missing	No
Treeing	No
Broken separators	No

GENERAL INFORMATION

Elements hard to remove from jars Yes No. of spacers per cell 2

Probable cause of failure Bridging across separators on side and bottom. Shedding of positive plate active material.

Observer Claude Merrill, Jr.

Checked By Louis Mastaler

DISASSEMBLY REPORT

Inclosure 7

TABLE VII

Manufacturer's Code	Code "A"	Date	20 July 1955
Type	2HN	Test	Overcharge
Battery Code	A-2	Cycles	8

General Appearance Before Disassembly: Good

POSITIVE PLATES

Upper quarter bare	Yes
Lower quarter bare	No
Bare in spots (Top)	Yes
Shedding in chunks	No
Shedding uniform	No
Shedding normal	No
Remainder firm-surf.smooth	Yes
Remainder firm-surf.pitted	No
Remainder appeared lumpy	No
Remainder soft & loose	Loose
Surface scaly	No
Loose matl.stuck to sep	Yes
Oxidation of grids	Yes
Buckling	No
Distortion of grid frames	Yes
Grid frames broken	Yes

SEDIMENT SPACES

One fourth full	Yes
Treed	No
Overflowing-elements bridged	No
Color	Brownish

NEGATIVE PLATES

Color	Grey
Expanded	Slight
Surface blistered	No
Surface spongy Yes sandy	Yes
Density of interior-upper half	Good
Density of interior-lower half	Good

SEPARATORS

Type	Microporous rubber
Flexibility	Good
Degree of oxidation	No
Any holes	No
Fringed at bottom	No
Exceptionally thin	No
Capable of being handled intact	Yes
Badly disintegrated parts missing	No
Treeing	No
Broken separators	No

GENERAL INFORMATION

Elements hard to remove from jars No No. of spacers per cell None

Probable cause of failure: Almost complete disintegration of positive grid.

Observer: Robert Young

Checked By: Louis Mastaler

DISASSEMBLY REPORT

Inclosure 8

TABLE VIII

ORDMX-EA
ab 50 3988

LABORATORY WORK ORDER
Use by Dev. & Eng. Dept.

ORDNANCE DEPARTMENT
DETROIT ARSENAL

TO: Chief, Laboratories Division 12 September 1955

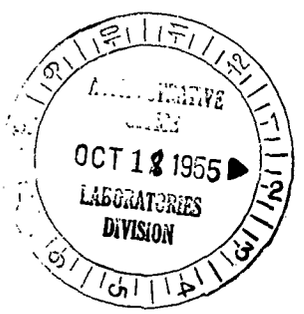
DESCRIPTION OF WORK IN DETAIL:

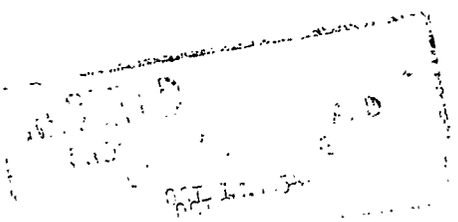
PROJECT ENGINEER: R. H. Sage/la/3-4134 - ORDMX-ECPE

SUBJECT: Tests of [redacted] Type 2HN Batteries

1. Subject [redacted] type 2HN batteries to all tests prescribed in Specification MIL-B-11188A.

2. Monthly memo report is requested, and final report upon completion of project.





CERTIFIED AS TO PROPRIETY
& FORM EXAMINATION

ELECTRICAL LABORATORY

SERIAL NO. 2450

COMPLETION NOTICE	ESTIMATE MUST NOT BE EXCEEDED. QUOTE FULL X.O. AND PART NOS. ON ALL PROCUREMENTS AND JOB CARDS.		PROJ. NO. TT1-720B
COMPLETION DATE	LAB. LABOR ONLY	EST.	EX. ORDER 1640-1-3
LAB. BR. CHIEF	MATERIAL AND WORK OF OTHER DEPARTMENTS	EST.	EX. ORDER
	APPROVED		
LAB. DIV. CHIEF	BRANCH CHIEF OF Components	DIVISION CHIEF OF Res & Dev	CHIEF, DEV. & ENG. DEPT.